

Private Unpaved Roads Survey

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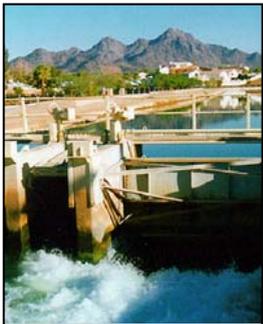
Purpose of Private Unpaved Roads Survey

■ Record these attributes of private unpaved roads:

- Locations
- Approximate traffic volumes
- Approximate limits to speed
- Stabilization – stabilized, temporary stabilization by weather, unstabilized
- Road materials – paving, asphalt millings, gravel, dirt, dirt with dust palliatives
- Access restrictions
- Road type, width and predominant use

■ Collect additional qualitative data on PM-10 emissions:

- Digital photos of roads, front and rear facing cameras
- Relative PM-10 concentrations from vehicle-mounted monitor versus vehicle speed



Background: How a dust plume from an unpaved road develops

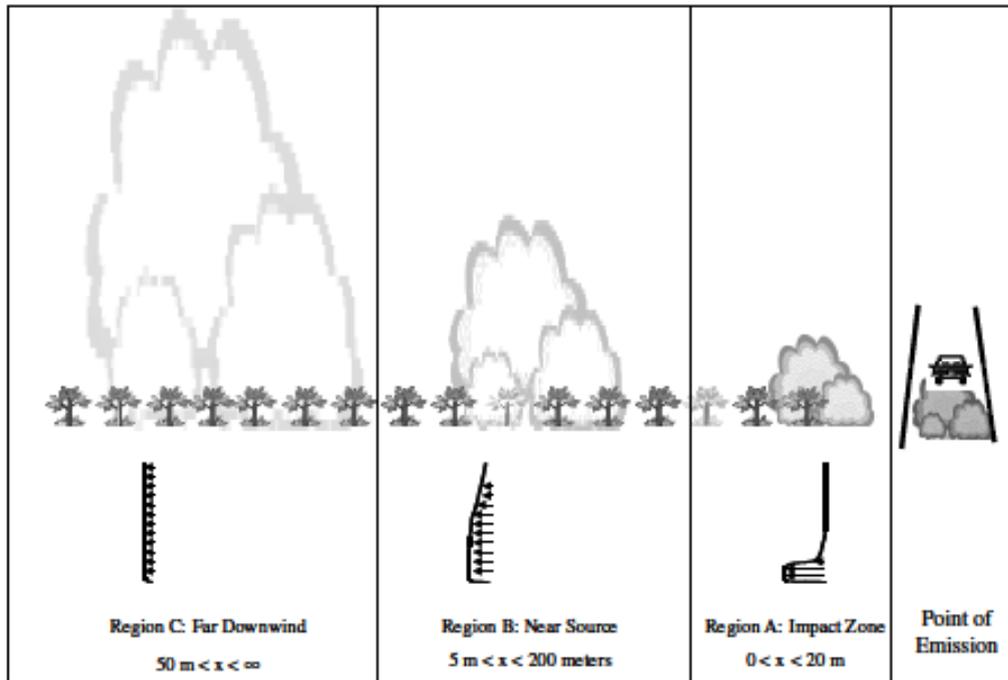


Figure 2-1. Development of a dust plume downwind of an unpaved road

Background: PM-10 concentrations and deposition rates with distance

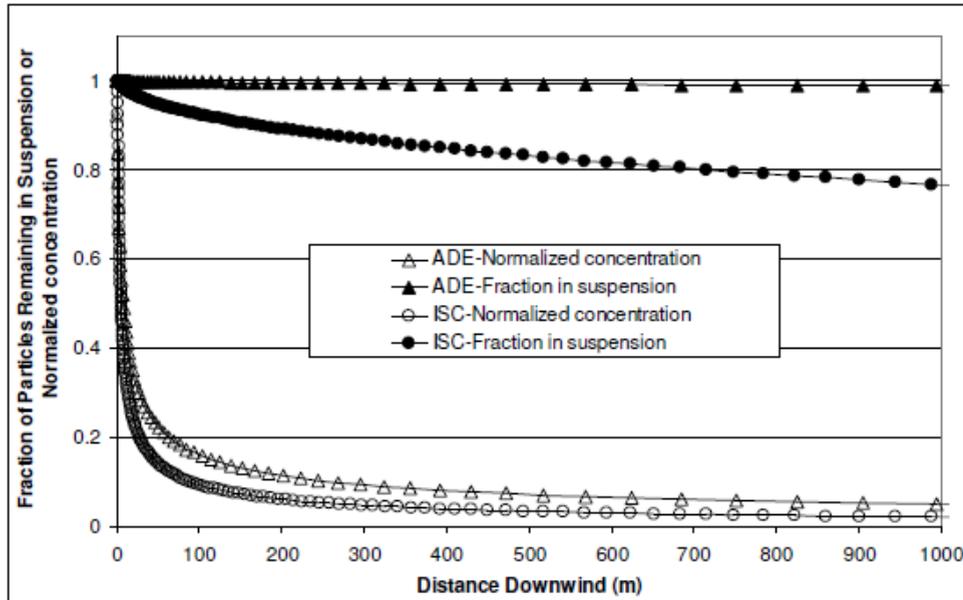
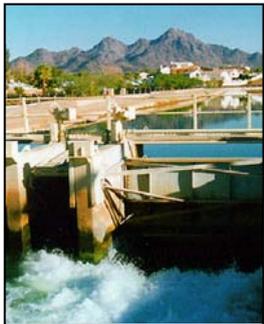
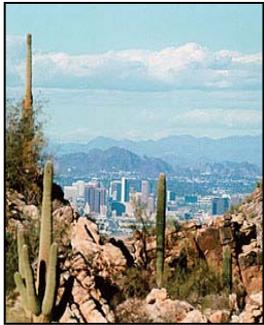


Figure 4-6. The fraction of particles remaining in suspension and the Concentration at a height of 1 meter above ground level vs. time for neutral atmospheric conditions according to the ADE and ISC3 models. $z_0=0.01$ m, $D_p=8$ μ m, $u_* = 0.3$ m/s in all cases.

Background: PM-10 impacts from unpaved road dust



- PM-10 concentrations from an unpaved road dust plume are highest at the source of the dust plume and diminish quickly with distance
- Plumes are usually only generated as a vehicle passes over the road. Unpaved roads with low traffic volumes may only produce sporadic dust plumes
- PM-10 impacts are greatest for those who live nearest to an unpaved road with high traffic volumes

Background: How unpaved road dust emissions are estimated

- EPA AP-42 emission factor formula:

- For industrial/haul unpaved roads:

$$E = k (s/12)^a (W/3)^b$$

- For publicly accessible roads, mostly light vehicles:

$$E = \frac{k (s/12)^a (S/30)^d}{(M/0.5)^e} - C$$

where k , a , b , c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)

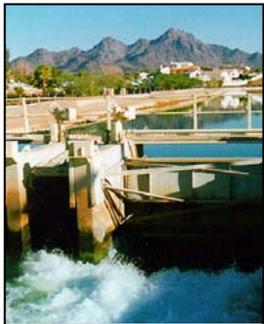
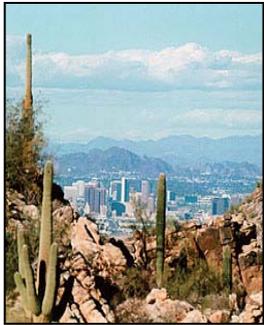
s = surface material silt content (%)

W = mean vehicle weight (tons)

M = surface material moisture content (%)

S = mean vehicle speed (mph)

C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.



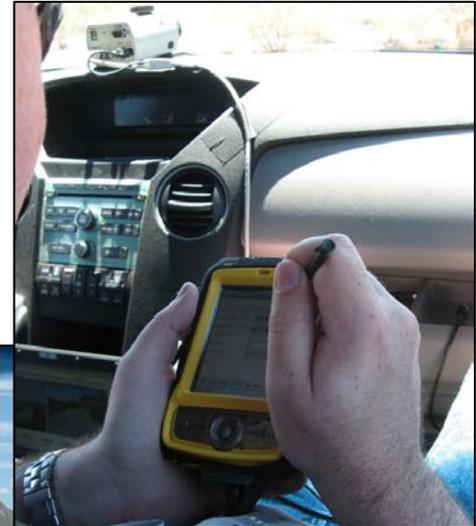
Data Collection

Mobile Sampling Methods

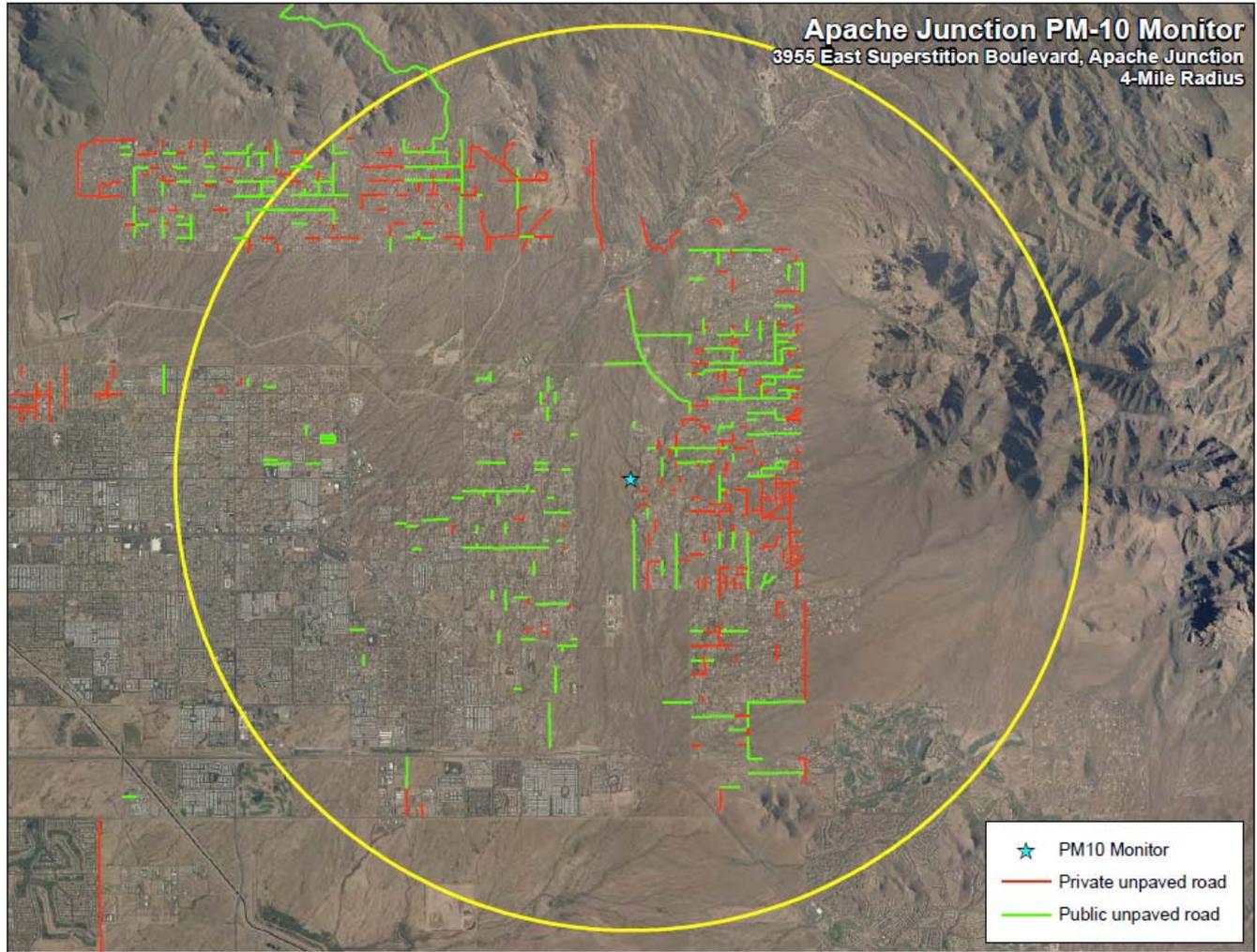
- **Mobile SUV with measurements**
 - **Cameras, dust monitoring, GPS location**
 - **Attribute documentation**



Data Collection Mobile Sampling Methods



Apache Junction PM-10 Monitor
3955 East Superstition Boulevard, Apache Junction
4-Mile Radius



Preliminary Data Collection Apache Junction Region Public Road



<u>Last Scan</u>	<u>Battery</u>	<u>Speed</u>	<u>Direction</u>	<u>PM10</u>
14:44	12.73	17.4	332	23.64

Preliminary Data Collection Apache Junction Region Private Road



<u>Last Scan</u>	<u>Battery</u>	<u>Speed</u>	<u>Direction</u>	<u>PM10</u>
09:28	12.73	6.6	092	1.342

Preliminary Data Collection Apache Junction Region Private Road



Last Scan

10:41

Battery

12.55

Speed

7.6

Direction

359

PM10

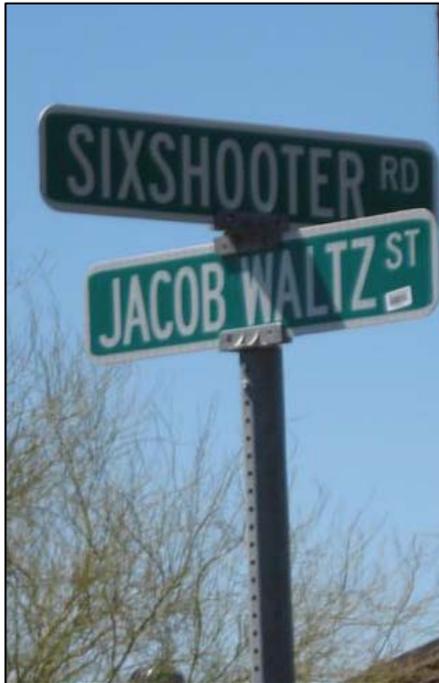
0.569

Preliminary Data Collection Apache Junction Region Private Road – Gravel



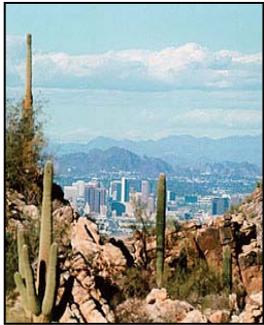
<u>Last Scan</u>	<u>Battery</u>	<u>Speed</u>	<u>Direction</u>	<u>PM10</u>
11:10	12.73	5.9	177	0.082

Preliminary Data Collection Apache Junction Region Private Road Pictures of Interest

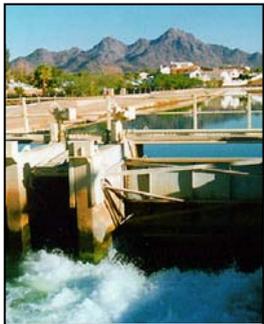


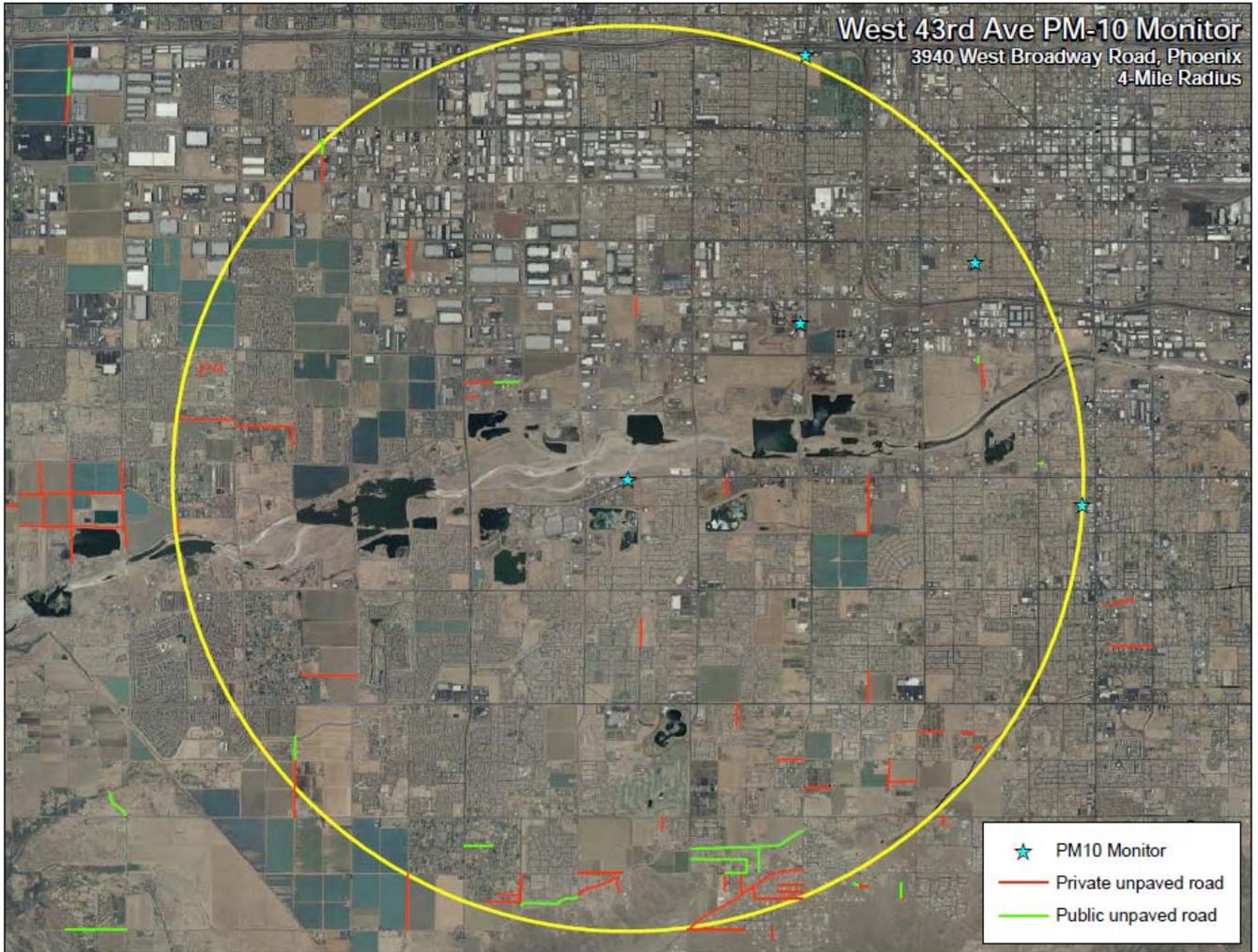
Preliminary Data Collection

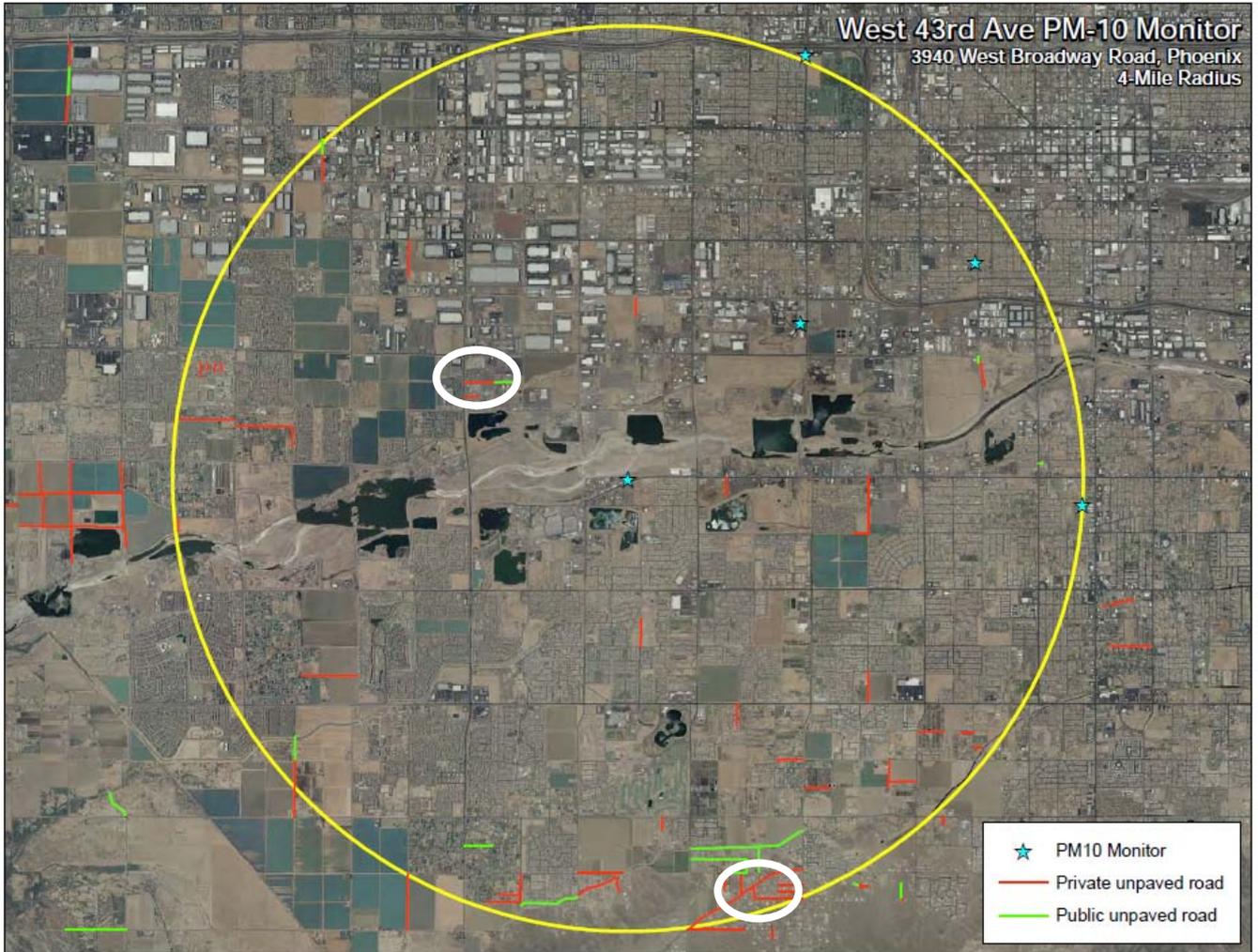
West 43rd Ave Monitor Region



- While the miles of unpaved roads are significantly less around the W43rd monitor than than Apache Junction monitor, the road locations relative to the W43rd monitor *may* have more of an impact
- Roads were generally better graded allowing higher vehicle speeds
- At least one of the same road areas noted in the 2006 PM-10 Source Attribution and Deposition Study was still a problem







Preliminary Data Collection

W43rd

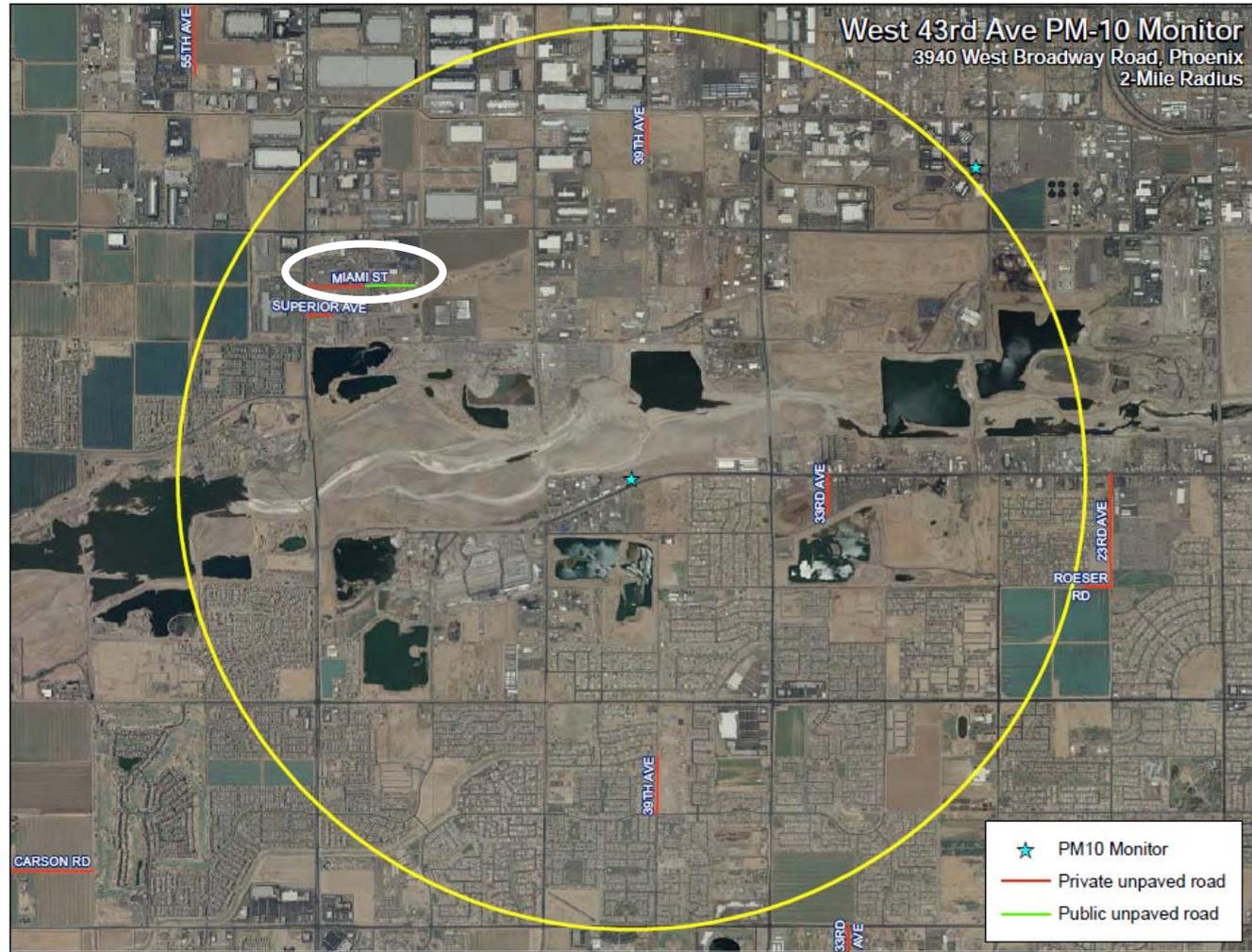
Private Road – South of W43rd



Time: 15:13:40

Speed: 16.3

PM-10: 6.7



Preliminary Data Collection W43rd Private Road – West of W43rd



Time: 16:38:00

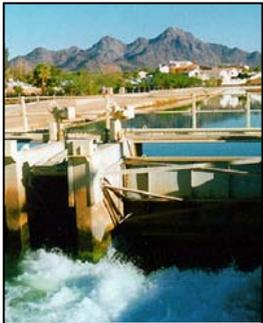
Speed: 10.1

PM-10: 10.8

2006 Observations from Same Road

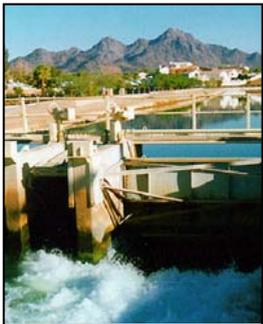


Preliminary Observations Summary



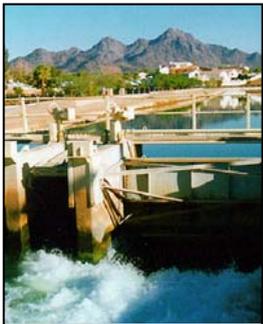
- Based on the measured air quality data at the Apache Junction monitor, it appears that private and public unpaved roads do not cause PM-10 exceedances, as demonstrated by Apache Junction monitor
 - Nature of the private unpaved roads doesn't allow higher vehicle speeds
 - Rapid decrease in PM-10 concentration with distance
 - Location of the roads relative to the monitor and the prevailing wind direction
- Even though unpaved roads don't appear to cause exceedances at this specific monitor, the emissions still contribute to the PM-10 burden in the non-attainment area

Preliminary Observations Summary



- Based on the measured air quality data at the W43rd monitor, it appears that unpaved roads *may* contribute to the PM-10 exceedances at the monitor
 - High traffic volume on a dirt road
 - Road location places it upwind of the monitor in the prevailing wind direction
 - Even with a fairly rapid decrease in concentrations downwind of the road, the total PM-10 burden *may* still contribute to the values observed at the W43rd site

Preliminary Observations Summary



- For other monitors that do show exceedances, the local PM-10 emissions can be reduced by control of unpaved road emissions
 - Paving
 - Dust suppressants (limited to reduced traffic volume conditions)
 - Alternative road materials
 - Traffic speed control
- Average cost for paving dirt roads is approximately \$500,000 per mile (does not include right of way purchase)

Preliminary Observations Summary



- How do you achieve the biggest bang for the buck in controlling emissions?
 - Control unpaved roads near monitors
 - Control unpaved roads (private or public) with high traffic volumes
 - Control unpaved roads near residences and businesses with high traffic volumes
 - Limiting the speed of travel on unpaved roads

